World's first space telescope to discover near-Earth objects

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Canada is building the world's first space telescope designed to detect and track asteroids as well as satellites. Called NEOSSat (Near Earth Object Surveillance Satellite), this spacecraft will provide a significant improvement in surveillance of asteroids that pose a collision hazard with Earth and innovative technologies for tracking satellites in orbit high above our planet.

Weighing in at a mere 65-kilograms, this dual-use $12-million mission builds upon Canada's expertise in compact "microsatellite" design. NEOSSat will be the size of a large suitcase, and is cost-effective because of its small size and ability to "piggyback" on the launch of other spacecraft. The mission is funded by Defence Research Development Canada(DRDC) and the Canadian Space Agency(CSA). Together CSA and DRDC formed a Joint Project Office to manage the NEOSSat design, construction and launch phases. NEOSSat is expected to be launched into space in 2010. The two projects that will use NEOSSat are HEOSS (High Earth Orbit Space Surveillance) and the NESS (Near Earth Space Surveillance) asteroid search program.

"Canada continues to innovate and demonstrate its technological expertise by developing small satellites that can peer into near and far space for natural and man-made debris," says Guy Bujold, President of the Canadian Space Agency. "We are building the world's first space-based telescope designed to search for near-Earth asteroids."

NEOSSat is the first follow up mission to the groundbreaking MOST

(Microvariability and Oscillation of STars) spacecraft, a 60-kilogram satellite designed to measure the age of stars in our galaxy. NEOSSat also marks the first project using Canada's Multi-Mission Microsatellite Bus. CSA's Space Technology branch launched the Multi-Mission Bus project to capitalize on technology developed for the MOST project by making it adaptable to future satellite missions.

Captain Tony Morris of DRDC Ottawa, and Deputy Program Manager of the NEOSSat Joint Project Office, says, "NEOSSat is a technological pathfinder for us to demonstrate the potential of microsatellite technologies to satisfy operational requirements of the Canadian Forces. NEOSSat will demonstrate the ability of a microsatellite to enhance the CF's contribution to the NORAD mission – providing accurate knowledge of the traffic orbiting our planet. This would contribute to the safety of critical Canadian assets, military and civilian, in an increasingly congested space environment."

Dr. Brad Wallace leads the science team at DRDC for HEOSS, which will use NEOSSat for traffic control of Earth's high orbit satellites. Dr. Wallace says, "We have already done satellite tracking tests using MOST, so we know that a microsatellite can track satellites. The challenge now is to demonstrate that it can be done efficiently, reliably, and to the standards required to maximize the safety of the spacecraft that everyone uses daily, like weather and communication satellites."

The HEOSS project will demonstrate how a microsatellite could contribute to the Space Surveillance Network (SSN), a network of ground based telescopes and radars located around the world. Until the 1980s, Canada contributed to the SSN with two ground-based telescopes in eastern and western Canada. The fact that HEOSS will be a space-based capability on a microsatellite represents an exciting enhancement to the contribution and offers significant advantages to the SSN. Ground-based sensors' tracking opportunities are constrained by their geographic

location and the day-night cycle. In Sun-synchronous orbit around our planet, NEOSSat will offer continuous tracking opportunities and the ability to track satellites in a wide variety of orbit locations.

"NEOSSat requires remarkable agility and pointing stability that has never before been achieved by a microsatellite," says David Cooper, General Manager of Mississauga-based Dynacon Inc., the prime contractor for the NEOSSat spacecraft and the manufacturer and operator of the MOST satellite. "It must rapidly spin to point at new locations hundreds of times per day, each time screeching to a halt to hold rock steady on a distant target, or precisely track a satellite along its orbit, and image-on-the-run." Cooper says. "Dynacon is the world leader in this microsatellite attitude-control-system technology."

Dr. Alan Hildebrand, holder of a Canada Research Chair in Planetary Science in the University of Calgary's Department of Geoscience, leads an international science team for the NESS asteroid search project and is excited by its prospects.

"NEOSSat being on-orbit will give us terrific skies for observing 24-hours a day, guaranteed," Hildebrand says. "Keeping up with the amount of data streaming back to us will be a challenge, but it will provide us with an unprecedented view of space encompassing Earth's orbit."

Although NEOSSat's 15-centimetre telescope is smaller than most amateur astronomers', its location approximately 700 kilometres above Earth's atmosphere will give it a huge advantage in searching the blackness of space for faint signs of moving asteroids. Twisting and turning hundreds of times each day, orbiting from pole to pole every 50 minutes, and generating power from the Sun, NEOSSat will send dozens of images to the ground each time it passes over Canada. Due to the ultra-low sky background provided by the vacuum of space, NEOSSat will be

able to detect asteroids delivering as few as 50 photons of light in a 100-second exposure.

Hildebrand, who oversees the U of C's ground-based asteroid observation program using the Rothney Astrophysical Observatory's wide-field Baker Nunn telescope, said NEOSSat will greatly enhance the study of asteroids and comets as they approach Earth. "NEOSSat will discover many asteroids much faster than can be done from the ground alone. Its most exciting result, however, will probably be discovering new targets for exploration by both manned and unmanned space missions," he observes. "By looking along Earth's orbit, NEOSSat will find 'low and slow' asteroids before they pass by our planet and sprint missions could be launched to explore them when they are in the vicinity of the Earth."

Source: University of Calgary